Acceleration Day One

Wafi Hassan P1.

Using the information given complete the chart

DIST. (M)	TIME (S)	Δ TIME (S)	VELO.$_1$ (M/S)	ACC.$_1$ (M/S^2)
0 M	0	0	0	0
2.5M	0.908	0.908	2.75	2.75
5 M	1.34	0.432	5.78	7.014
7.5 M	1.791	0.451	5.54	-0.52
10 M	2.234	0.443	5.69	0.231

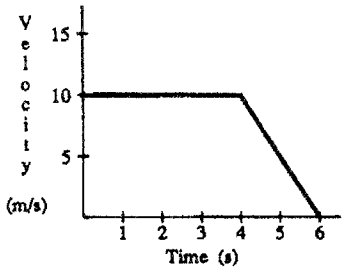
2) *A jumbo jet racing down the runway receives word that it must return to the gate to pick up an important passenger who was late to his connecting flight. The jet is traveling at 45 m/s when the pilot receives th message. What is the acceleration (deceleration) of the plane if it takes the pilot 5 s. to bring the plane to a halt?* $\frac{0-45}{5} = -\frac{45}{5} = \boxed{-9\ m/s^2}$

3) *While driving his sports car at 20 m/s down a four-lane highway, Eddie comes up behind a slow moving dump truck and decides to pass it in the left hand lane. If Eddie can accelerate at 5 m/s^2, how long will it take for him to reach a speed of 30 m/s?* $\frac{30-20}{t} = 5 \Rightarrow 5t = 10 \therefore \boxed{t=2} \therefore \boxed{2\ seconds}$

4) *From the moment a 90 mi/ hr fastball touches the catcher's mitt until it is completely stopped takes .012 s. Calculate the average deceleration of the ball as it is caught.*

$3600s = 1.6 \times 90 \quad 1s = \frac{1.6 \times 90}{3600} = 0.04\ km = 40\ m/s \qquad \frac{0-40}{0.012} = -\frac{40}{\frac{12}{1000}} = -40 \times \frac{1000}{12} = -3333.\overline{3}\ m/s^2$

5) *a) Describe the car's motion from t=0 to t=4 s. b) Describe the car's motion from t= 4 s to t=6 s. c) What is the average acceleration for the first 4 s? d) what is the average acceleration from t= 4 s to t=6s*



a) The car has no acceleration, thus travelling at a steady velocity

b) The car is decreasing velocity at a steady rate. Slowing down with constant deceleration

c) $\boxed{0\ m/s^2}$

d) $\frac{0-10}{6-4} = -\frac{10}{2} = \boxed{-5\ m/s^2}$

Acceleration 2

Wafi Hassan P1

9) *A golf ball rolls up a hill toward a Putt-Putt hole.*

a) if it starts with a velocity of +2 m/s and accelerates at a constant rate of - .5 m/s^2, what is its velocity after 2 s? $\frac{v-u}{2} = -\frac{1}{2} \Rightarrow v-2=-1 \therefore v = 1$ m/s

b) if the acceleration occurs for 6 s, what is its final velocity? $v-2 = -\frac{1}{2} \times 6 \Rightarrow v = -3+2 \therefore v = -1$ m/s

c) describe, in words the motion of the golf ball?

The golf ball moves uphill slowing down at a steady rate, until becomes stationary then moves downhill picking up speed at a steady rate

10) *A bus traveling at +30 km/h accelerates at a constant +3.5 m/s^2 for 6.8 s. What is its final velocity in km/h?*

50 25
30000
3600
83

$\frac{v-(30)}{6.8} = 3.5$ ~~$v-30 = 23.8$~~ $\Rightarrow \frac{v-25}{5} = 23.8$

~~$\therefore v = 58.8$ km/h~~ $\Rightarrow v = 32.13$ m/s $= 115.7$ km/h

11) *If a car accelerates from rest at a constant 5.5 m/s^2, how long in time will be required to reach 28 m/s?*

$t = \frac{v^2-u^2}{a} = \frac{(v+u)(v-u)}{5.5} = \frac{28-0}{5.5} = \frac{28}{5.5} = 5.1$s

12) *A car slows from 22 m/s to 3 m/s with a constant acceleration of -2.1 m/s. How long in time does it require?*

$\frac{3-22}{-2.1} = \frac{-19}{-2.1} = 9.05$s.

13) *A race car traveling at +44 m/s is uniformly accelerated to a velocity of +22 m/s over an 11 s interval. What is its displacement during the time?*

$\frac{22^2-44^2}{2.\frac{22-44}{11}} = s \Rightarrow \frac{-1452}{-4} = s \therefore s = 363$ m

14) *A rocket traveling at +88 m/s is accelerated uniformly to +132 m/s over a 15 s. interval. What is its displacement during this time?*

$a = \frac{132-88}{15} = \frac{44}{15}$ $s = ut + \frac{1}{2}at^2 = 88(15) + \frac{1}{2} \cdot \frac{22}{\frac{44}{15}} \cdot (15)^2$

$= 1320 + 330 = 1650$m

15) *A car accelerates at a constant rate from 15 m/s to 25 m/s while it travels 125 m. How long in time does this motion take?*

$a = \frac{v^2-u^2}{2s} = \frac{25^2-15^2}{2(125)} = \frac{8}{5}$

$t = \frac{25-15}{\frac{8}{5}} = 10 \times \frac{5}{8_4} = \frac{25}{4} = 6.25$s

$= 6.25$s

Acceleration 4

Wafi Hassan P1

1) Fluffy, initially at rest, falls toward the Earth for 8.0 s. If $g = -9.8\ m/s^2$ the final speed of the fur ball is about (1) 1.8 m/s (2) 8.0 m/s (3) 10 m/s (4) 10 m/s^2 (5) 80 m/s $0 - 9.8(8) =$

2) Fluffy becomes an international space traveler and falls freely near the surface of a planet. The object has an acceleration due to gravity of 15.8 m/s^2. How far will the Fluff dude fall during the first second?
(1) 15.8 m (2) -7.9 m (3) 49 m (4) 5 m
$ut + \frac{1}{2}(15.8) \cdot 1$

3) Fluffy joins the carnival and becomes the first stunt cat. He is shot from a cannon vertically upward at 35 m/s. His velocity after 5 s. ($g = -9.8\ m/s^2$) is approximately (1) 7 m/s up (2) 15 m/s down (3) 15 m/s up (4) 85 m/s down (5) 85 m/s up

4) A mean man drops poor Fluffy (mass = 2kg.) from the roof of a building. He takes 4.0 s to reach the ground. Neglecting air resistance the maximum speed of Fluff-in-stuff will be approximately (1) 8.0 m/s (2) 10 m/s (3) 30 m/s (4) 40 m/s The distance Fluffy fell is approximately 78m.
$mgh \quad \frac{1}{2}(-9.8)(4)^2 \quad 0 + (-9.8)(4)$

5) Fluffy wants to jump up to a table top to meet with his true love, Snowball. If the height of the table is 1.2 m, what is the launch velocity that Fluffy needs to have reached the top of the table?
4.85 m/s
$0 = u^2 + 2as$
$-2(-9.8)\cdot(1.2) = u^2$

6) Fluffy is thrown upward, his velocity _____. a) increases b) decreases c) remains the same

7) Fluffy is thrown upward, his acceleration _____. a) increases b) decreases c) remains the same

8) A softball is thrown straight up, reaching a maximum height of 20 m. Neglecting air resistance, what is the ball's approximate vertical velocity when it hits the ground?
(1) 10 m/s (2) 20 m/s (3) 15 m/s (4) 40 m/s
$v^2 = u$ $\quad 2v^2 - v^2 = 2as$ $\quad \frac{2v^2}{2a} \quad v^2 = as \quad \sqrt{as}$

9) Fluffy wants to see if he can jump higher than Wafi. To give Wafi a fair chance Fluffy doubles his mass to 4 kg and now is only able to leap at a launch velocity of 4 m/s. Wafi accepts the challenge and is allowed to leap at his human weight and leaps with a launch velocity of 3 m/s. If they are measuring from their center of mass, who jumps higher? Fluffy

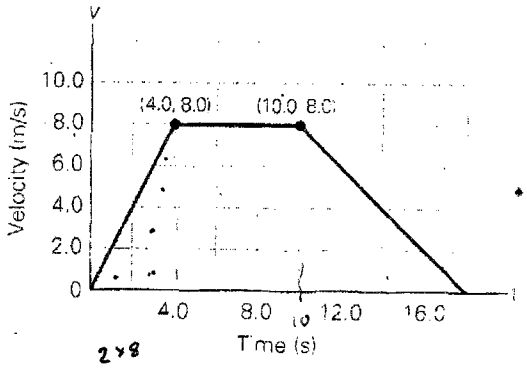
10) Suppose you were to throw a ball straight up in the air with an initial velocity of 15 m/s. Record the ball position at each .5 second using the formula

$$d = v_0 t + \frac{1}{2} a t^2$$

t (s)	height (m)
0.5	6.275
1	10.1
1.5	11.475
2	10.4
2.5	6.875
3	0.9

AP Acceleration Problems -2

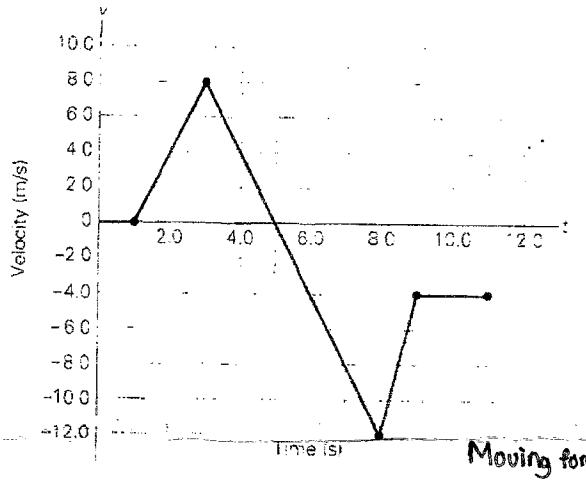
Afi Hassan.



1) Describe the motion of the object over the total time period. What is the total distance the vehicle traveled for the 18 seconds?

Constant acceleration for 4 seconds, moving at a steady pace for the next 6 seconds, slowing down at a steady rate for the last 8 seconds.

$16 + 24 + 32 = 72$ m.



2) (See diagram to the left) Compute the acceleration for each phase of motion. Describe how the object moves during each time segment.

1) • 0 m/s² → Moving forward at steady pace

2) • $\frac{8-0}{3-1} = 4$ m/s² → Moving at increasing pace forward

3) • $\frac{8-0}{3-5} = -4$ m/s² → Moving back & picking up pace at a steady rate.

4) • $\frac{-12+4}{8-7} = 8$ m/s² → Moving forward & picking up pace at a steady rate

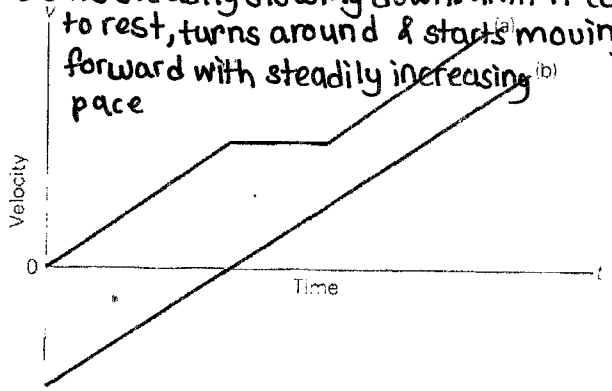
5) • 0 m/s² → Moving forward at steady pace

3) Describe the motions of the two objects that have the v vs t plots shown.

Moving forward, a steadily picks up pace, then reaches a steady pace for a while, & then starts steadily picking up pace again. b is initially moving back where its steadily slowing down. until it comes to rest, turns around & starts moving forward with steadily increasing pace

4) For the motion of a dropped object in free fall, sketch the general forms of the graphs of a) v vs t, and b) y vs t.

5) Sketch the general forms of the graphs of a) velocity vs. time for an object projected vertically upward.



6) A car and a motorcycle start from rest at the same time on a straight, but the motorcycle is 25 meters behind the car. The car accelerates at a uniform rate of 3.7 m/s², and the motorcycle at a uniform rate of 4.4 m/s². A) How much time elapses until the motorcycle overtakes the car? B) How far will each have traveled during that time? C) How far ahead of the car will the motorcycle be 2 seconds later? Both cars are still accelerating.

A) $s = ut + \frac{1}{2}at^2$

$25 = 0 + \frac{1}{2}(4.4 - 3.7)t^2$ ~~$\Rightarrow (3.7)t = 4.4(t)$~~

$\Rightarrow t^2 = \frac{25}{0.5(0.7)}$

$\Rightarrow t = \sqrt{\frac{25}{0.5(0.7)}} = \boxed{8.45\text{ s}}$ //

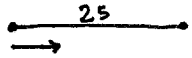
$25 = \frac{1}{2}(4.4)t^2$

B) Car → $(3.7)(8.45) = \frac{25}{2.2}$

→ 31.3 m

Motorcycle → $(4.4)(8.45)$

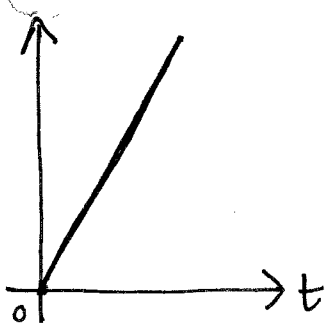
→ 37.18 m.



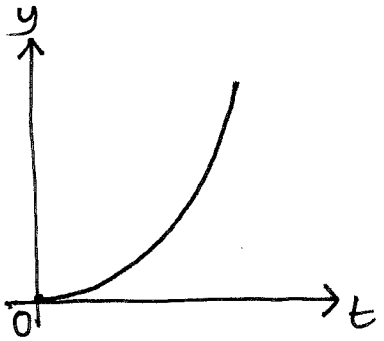
B) $\frac{1}{2} \times (3.7)(8.45)^2$

$= \boxed{132.1\text{ m}}$ //

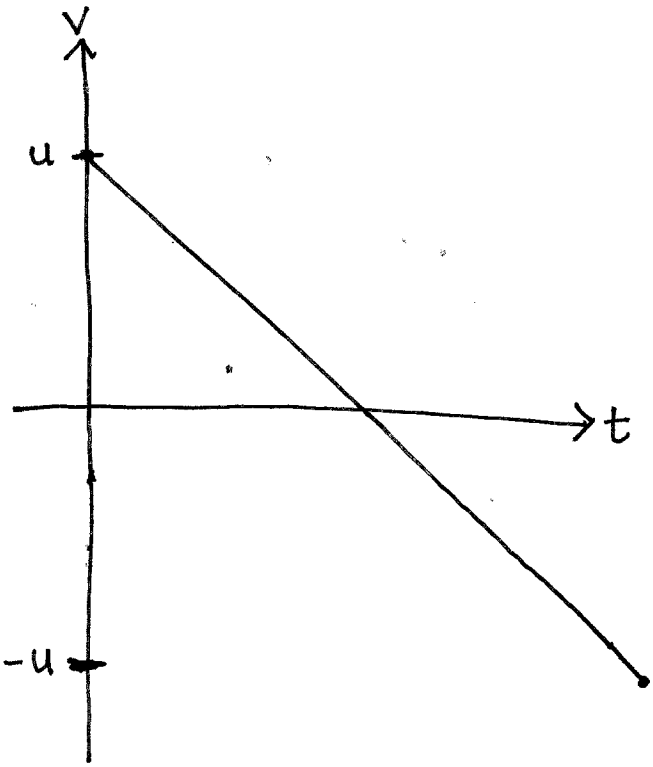
4) a)



b)



5) a)



6c) $\left[\frac{1}{2}(4.4)(10.45)^2 - 25\right] - \left[\frac{1}{2}(13.7)(10.45)^2\right]$

$\approx 215.245 - 202.02$

$= \boxed{13.23\ \text{m}}$

$v^2 = u^2 + 2as$

$v^2 = 22^2 + 2(-9.8)(62)$

$ut + \frac{1}{2}at^2 = s$

$22t + \frac{1}{2}(-9.8)t^2 = 62$

$\therefore t =$

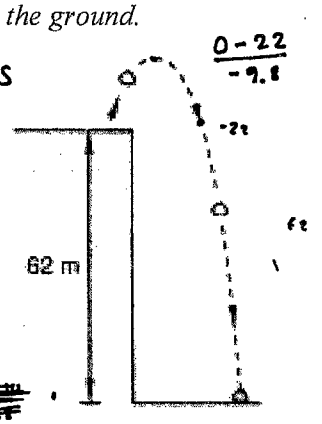
$\frac{V+22}{1.96} = -9.8$

Acceleration - Free Fall

Wati Iltas Can.

1) A stone is thrown straight up from ground level with an upward velocity of 14.6 meters per second. Find the time required for the object to hit the ground.

$\frac{-14.6 - 14.6}{-9.8} = 2.98\,s$



$\frac{0-22}{-9.8}$

-22

$200 = 0 + \frac{1}{2}(-9.8)t^2$

2) A rock is thrown straight up from a height of 62 meters. The initial velocity of the rock is 22 meters per second. (a) How long will it take for the rock to hit the ground below the cliff? (b) What is the velocity of the rock just before it hits the ground?

a) $2.245 \times 2 + 1.96 = 6.45\,s$ b) $-41.21\ m/s$

3) A projectile is propelled straight down from a height of 200 meters with an initial velocity of 10 meters per second. a) What amount of time will it take for the projectile to reach the ground? b) What is the velocity of the projectile just before it hits the ground?

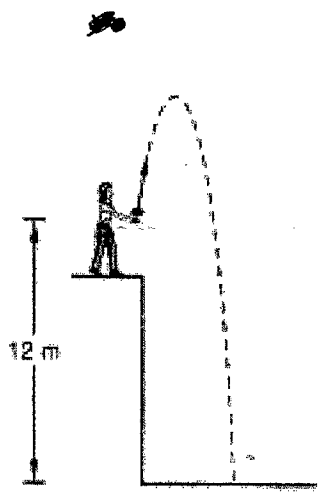
a) $1.02 + 6.39 = 7.41\,s$ b) $-72.618\ m/s$

4) A bullet is fired straight up with an initial velocity of 250 m/s. a) Find the maximum height the bullet reaches. b) Find how long it takes for the bullet to have a vertical velocity of zero (reach its highest point)

a) $0^2 = 250^2 + 2(-9.8)(s)$

$\therefore s = 3188.78\ m$

b) $t = \frac{v-u}{t} = \frac{0-250}{-9.8} = 25.5\,s$



5) Tracy throws a rock from a height of 12 meters above the surface of a lake. She throws the rock upward with a vertical velocity of 21 meters per second. Find the time required for the rock to hit the surface of the water below the cliff.

$0 = 21t + \frac{1}{2}(-9.8)t^2$

$t = 4.28\,s$

$-12 = -21t + \frac{1}{2}(-9.8)t^2$

$t = 0.51$

$\therefore t = 4.28 + 0.51\,s$

$= 4.79\,s$

$a = -9.8$

$u = 10\ m/s$

$s = 200\,m$

$\frac{v-u}{0} = 626.0$

$v = \sqrt{100 + 2(-9.8)\cdot(200)}$

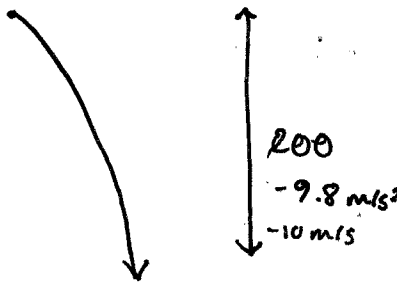
3) ~~$v=\sqrt{(-10}$~~ $v^2=u^2+2as$

$\Rightarrow v=\sqrt{u^2+2as}$

$=\sqrt{100+2(-9.8)(-200)}$

$=\pm\sqrt{4020}$

$\therefore v=-63.4$



a) $\frac{v-u}{a}=t$

$\Rightarrow \frac{-63.4--10}{-9.8}=t$

$\therefore \boxed{t=5.45s}$

b) $\boxed{v=-63.4\ m/s}$

+1

Name Wafi Hassan.
Period 1.

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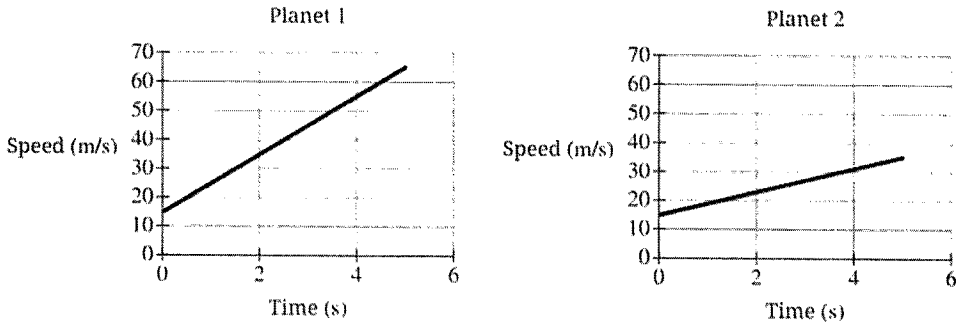
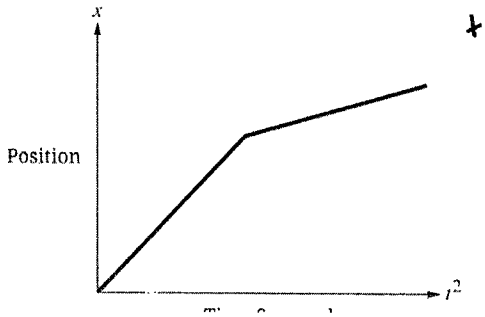
1)	a	21)	
2)	c b	22)	
3)	a c b	23)	
4)	a ; d	24)	
5)	~~d~~ ~~B~~ OK	25)	
6)	~~a~~ D	26)	
7)	b	27)	
8)	~~B~~ ~~X~~ OK	28)	
9)	a	29)	
10)	c	30)	
11)	11.025 m	31)	
12)	c ✓	32)	
13)	~~-8.6 m/s~~ ; 28.7 m/s	33)	
14)		34)	
15)		35)	
16)		36)	
17)		37)	
18)		38)	
19)		39)	
20)		40)	

Acceleration and Velocity Test '24



1) The graphs represent the speed of a ball thrown downward as a function of time near the surface of two planets. Which of the following correctly relates the acceleration a_1 of the ball near the surface of Planet 1 and the acceleration a_2 of the ball near the surface of Planet 2?

a) $a_1 > a_2 > 0$ b) $a_2 > a_1 > 0$ c) $(a_1 = a_2) > 0$ d) $a_1 = a_2 = 0$



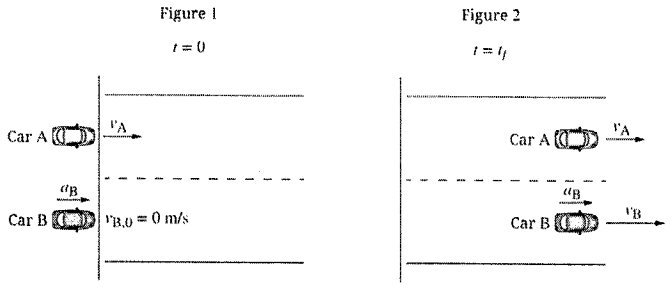
+1 2) A car starts from position x = 0 at time t = 0 and drives along a straight track. The graph shows the position of the car as a function of t^2. Which of the following statements correctly describes the motion of the car?

a) The car moves with constant speed, momentarily stops, and then moves again with the same speed

b) The car is speeding up at a constant rate, then continues to speed up but at a slower constant rate.

c) The car moves with constant speed, then it quickly slows down to a different, constant speed.

d) The car is speeding up at a constant rate, then slows down at a constant rate.



3) Car A is traveling to the right at a constant velocity v_A. At time t = 0, it passes car B, which is at rest. At the same time (t = 0), car B begins to accelerate with a constant acceleration of magnitude a_B as shown in Figure 1. Car B has a velocity of v_B when it reaches the same position as Car A at $t = t_1$, as shown in Figure 2.

Which of the following, if any, is an expression for the time it takes for Car B to catch up to car A.

a) $\frac{v_A}{a_B}$ b) $\frac{2v_A}{a_B}$ c) $\frac{2v_A^2}{a_B}$

d) It cannot be determined without knowing the distance traveled by the cars.

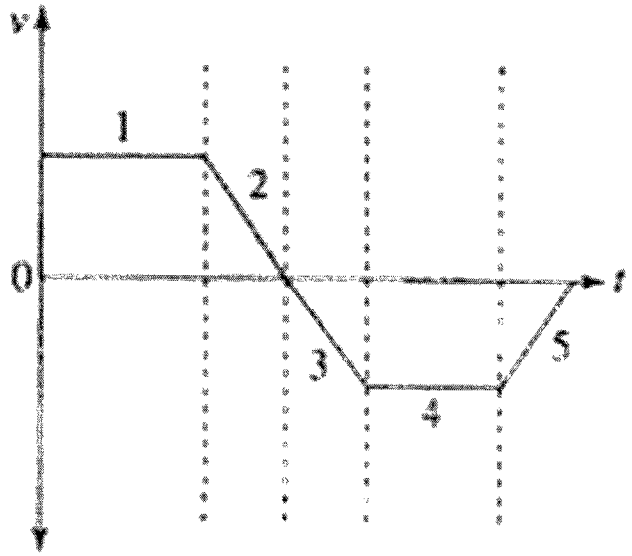
4) An object that's moving with constant speed travels once around a circular path. Which of the following statements are true concerning this motion? Select two answers.

a) The displacement is zero. b) The average speed is zero. c) The acceleration is zero.

0

Acceleration and Velocity Test '24

d) The velocity is zero.



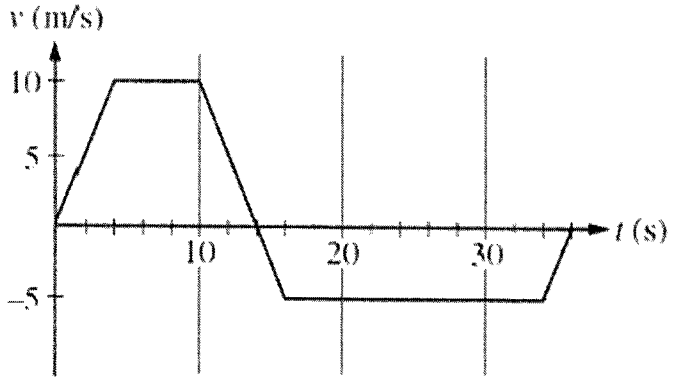
5) In section 5 of the velocity-time graph, the object is a) Speeding up moving in the positive direction b) Slowing down moving in the positive position c) Speeding up moving in the negative direction d) Slowing down moving in the negative direction

*6) Which of the following statements are true about uniformly accelerated motion?
a) If an object acceleration is constant, then it must move in a straight line.
b) If an object's acceleration is zero, then its speed must remain constant.
c) If an object's acceleration remains constant, then its acceleration must be zero.
d) If the object's direction of motion is changing, then its acceleration is not zero.

7) A baseball is thrown straight upward. What is the ball's acceleration at it highest point?
a) ½ g downward b) g downward c) ½ g upward d) g upward

Wafi Hassan.

Acceleration and Velocity Test '24



8. An object's velocity v as a function of time t is given in the graph above. Which of the following statements is true about the motion of the object?

(A) The object is not moving from $t = 4$ s to $t = 10$ s.
(B) The object's initial and final positions are the same.
(C) The object is slowing down from $t = 14$ s to $t = 16$ s.
(D) The average acceleration of the object from $t = 0$ s to $t = 4$ s is different from the acceleration from $t = 34$ s to $t = 36$ s.

$\frac{10-0}{4-0} = \frac{5}{2}$ $\quad \frac{-5}{36-34} = \frac{5}{2}$

9) How long would a car take, starting from rest and accelerating uniformly in a straight line at 5 m/s^2 to cover a distance of 200 m? a) 9 sec b) 10.5 sec c) 12 sec d) 15.5

$200 = \frac{1}{2}(5)t^2$ $\quad 400 = 5t^2$ $\quad t^2 = 80$ $\quad = 4\sqrt{5}$

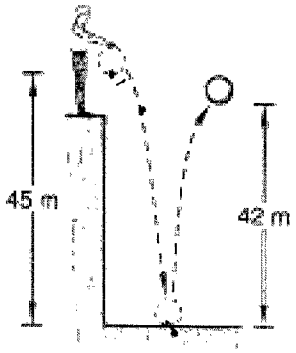
10) A rock is dropped off a cliff and strikes the ground with an impact velocity of 29.4 m/s. How high was the cliff? a) 19.6 m b) 29.4 m c) 44.1 m d) 78.4 m

11) Jack is playing with his pet cat, Fluffy. Jack tosses Fluffy up in the air. It takes Fluffy 3 seconds to land back in Jack's hands. How high did Fluffy travel in the air?

$s = ut + \frac{1}{2}(-9.8)(1.5)^2$

12) A car traveling at a speed of v_0 applies its brakes, skidding to a stop over a distance of x meters. Assuming that the brakes remain constant, what would be the skidding distance of the same car if it were traveling with twice the initial speed?

a) 2x m b) 3x m c) 4x m d) 8x m



13) Eric threw a rubber ball straight down with an initial velocity of 8.6 meters per second from a height of 45 meters above the pavement. The ball had a mass of 2.3 kilograms. It rebounded 42 meters. (a) What was the maximum vertical velocity of the rubber ball on the way down and on the way up?

$0^2 = u^2 + 2as$ $\quad = u^2 + 2(-9.8)(42)$

$-v = u + at$ $\quad -2u = -9.8(1.5)$

$0^2 = 28.7^2 + 2(-9.8)(m)$

The Projectile Ruler Lab

Wafi Hassan

The purpose of this lab is to predict the path of a ball's path as it falls from a ramp. In order to do this correctly you must find the position of the ball at .1 s, .2 s, 3 s and .4 s. A projectile will travel with a horizontal velocity that is at constant speed. It will also (de)accelerate in the vertical direction based on the acceleration of gravity. By putting the two speeds together you will be able to predict the position of the ball at the chosen times

Materials: Remco Ramp, Remco ball, ruler, string, and washers

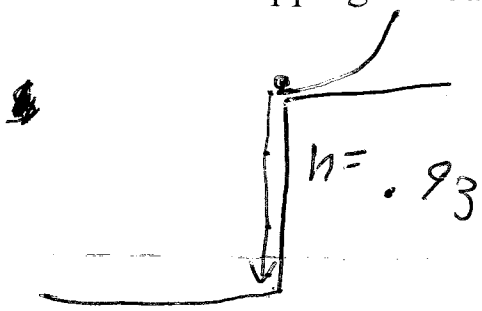
Procedure: Predict the speed the ball as it comes off the ramp. Predict the time the ball is in the air based on the height the ramp is from floor. Once you know the time the ball is in the air, use the constant velocity formula and the position formula to find its position at each time interval. Once you have found the position of the ball at .1 s, .2 s, .3 s and .4 s hang one washer at each time interval. Then, find me and I will video the path of the ball as you drop the ball from the ramp.

Automatic disqualification: Practice dropping the ball before video has been taken.

$u = 0$?

$g = -9.8$

$s = 93$ cm



- $t = \sqrt{\frac{2h}{g}}$

$= \sqrt{\frac{2(0.93)}{-9.8}}$

$t = 0.44$s

- $v = d/t$

$= 0.75/0.44$

$= 1.7$ m/s

$h = ut + \frac{1}{2}gt^2$

$\Rightarrow h = \frac{1}{2}gt^2$

$\Rightarrow 2h = gt^2$

$\Rightarrow t^2 = \frac{2h}{g}$

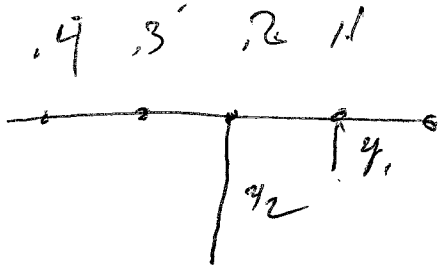
$\therefore t = \sqrt{\frac{2h}{g}}$

$d_{Horizontal} = 1.7(0.1) = 0.17$ m

$= 1.7(0.2) = 0.34$ m

$= 1.7(0.3) = 0.51$ m

$= 0.$



$s = ut + \frac{1}{2}gt^2$

$= \frac{1}{2}(-9.8)(0.1)^2 = 4.9$ cm

$= \frac{1}{2}(-9.8)(0.2)^2 = 19.6$ cm

$= \frac{1}{2}(-9.8)(0.3)^2 = 44.1$ cm

$= \frac{1}{2}(-9.8)(0.4)^2 = 78.4$ cm.

Wafi Hassan

Projectile Motion Review

1) Which of the following operations will not change a vector? a) Multiply it by a constant factor b) rotate it c) translate it parallel to itself d) add a constant vector

2) The resultant of two vectors is the smallest when the angle between them is a) 90° b) 45° c) 0° d) 180°

3) Two vectors, of magnitude 20 and 50 , are added. Which one of the following is a possibility for the magnitude of the resultant? a) 80 b) 40 c) 20 d) 10

30 - 70

4) A ball is thrown with a velocity of 20 m/s at an angle of 60° above the horizontal. What is the horizontal component of its velocity at the exact top of its trajectory? a) 20 m/s b) zero c) 10 m/s d) 17 m/s

5) Ignoring air resistance, the horizontal component of a projectile velocity a) continuously decreases b) remains constant c) continuously increases d) is zero

6) A soccer ball is kicked with a velocity of 25 m/s at an angle of 45° above the horizontal. What is the vertical component of its acceleration as it travels along its trajectory? a) $-9.8\ m/s^2 \times \sin 45$ b) $9.8\ m/s^2 \times \sin 45°$ upward c) $-9.8\ m/s^2$ d) $9.8\ m/s^2$ upward

206.63 2653

7) At what angle should a water gun be aimed in order for the water to land with the greatest distance traveled (range)? a) 45° b) 0° c) 60° d) 30°

8) An Olympic athlete throws a javelin at four different angles above the horizontal, each with the same speed: 30°, 40°, 60°, and 80°. Which two throws cause the javelin to land the same distance away?
a) 40° and 60° b) 30° and 60° c) 40° and 80° d) 30° and 80°

9) You are throwing a ball for the second time. If the ball leaves your hand with twice the velocity it had on your first throw, its horizontal range, R, would be a) half as much b) twice as much c) 1.4 times as much d) four times as much

10) A stone is thrown horizontally with an initial speed of 10 m/s from the edge of a cliff. A stop watch measures the stone's trajectory time from the top of the cliff to the bottom to be 4.3 s. What is the height of the cliff? a) 91 m b) 22 m c) 43 m d) 77m

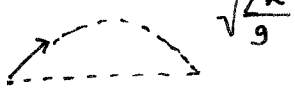
11) A girl throws a rock horizontally, with a velocity of 10 m/s, from a bridge. It falls 20 m. to the water below. How far does the rock travel horizontally before striking the water? a) 20 m b) 24 m c) 16 m d) 14 m

12) A jumper in the long-jump goes into the jump with a speed of 12 m/s at an angle of 20° above to the horizontal. How long is the jumper in the air before returning to the ground? a) 13 s b) .42 s c) .84 s d) .21 s

13) A jumper in the long-jump goes into the jump with a speed of 12 m/s at an angle of 20° above the horizontal. How far does the jumper jump? a) 3.4 m b) 6.2 m c) 15 m d) 9.4 m

14) A projectile is launched with an initial velocity of 60 m/s at an angle of 30° above the horizontal. What is the maximum height reached by the projectile? a) 92 m b) 46 m c) 23 m d) 69 m

$\frac{60^2 \sin^2(30)}{2 \times 9.8}$



$s = \frac{1}{2}(-9.8)t^2$

Name Wati Hassan
Period 1

-(95)

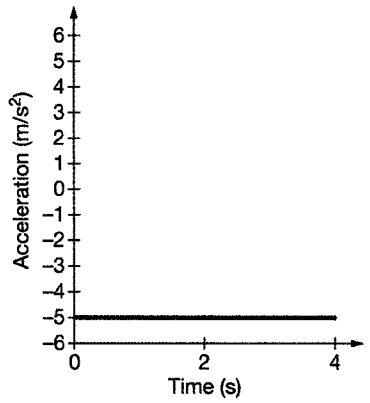
1)	e	21)	b
2)	b	22)	
3)	c	23)	
4)	a	24)	
5)	a	25)	
6)	c	26)	
7)	d	27)	
8)	d	28)	
9)	a b	29)	
10)	b	30)	
11)	a	31)	
12)	b	32)	
13)	c	33)	
14)	30.625 m	34)	
15)	40 m/s	35)	
16)	69.282 m/s	36)	
17)	7.07s	37)	
18)	45 m; 44.1 m	38)	
19)	c	39)	
20)	c (b)	40)	

Projectile Motion '24

Wafi Hassan

1) Balls 1 and 2 are each thrown horizontally from the same height above level ground, but ball 2 has a greater initial velocity after leaving the thrower's hand. If air resistance is negligible, how do the accelerations of the balls and the times it takes them to hit the ground compare?

a) acceleration greater for ball 2, time is greater for ball 2 b) acceleration greater for ball 2, time is equal c) acceleration is equal, time is greater for ball 2 d) acceleration is equal, time is less for ball 2 (e) acceleration is equal, time is equal



2) An object is released from rest near a planet's surface. A graph of the acceleration as a function of time for the object is shown for the 4 s after the object is released. The positive direction is considered to be upward. What is the displacement of the object after 2 s?

a) -20m b) -10 m c) 0 m d) 10 m e) 20 m $s = \frac{1}{2}(-5)(4)^2$

3) A ball is released from rest from the twentieth floor of a building. After 1 s, the ball has fallen one floor such that it is directly outside the nineteenth-floor window. The floors are evenly spaced. Assume air resistance is negligible. What is the number of floors the ball would fall in 3s after it is released from the twentieth floor? a) 3rd floor or less b) 4 to 6 floors c) 7 to 10 floors d) greater than 10 floors

4) Ignoring air resistance, the horizontal component of a projectile's acceleration
a) is zero. b) remains a non-zero constant. c) continuously increases.
d) continuously decreases

5) A soccer ball is kicked with a velocity of 25 m/s at an angle of 45° above the horizontal. What is the vertical component of its acceleration as it travels along its trajectory?

a) 9.80 m/s^2 downward b) (9.80 m/s^2) × sin (45°) downward
c) (9.80 m/s^2) × sin (45°) upward d) (9.80 m/s^2) upward

6) At what angle should a water-gun be aimed in order for the water to land with the greatest horizontal range?

a) 0° b) 30° c) 45° d) 60°

7) An Olympic athlete throws a javelin at four different angles above the horizontal, each with the same speed: 30°, 40°, 60°, and 80°. Which two throws cause the javelin to land the same distance away?

a) 30° and 80° b) 40° and 60° c) 40° and 80° d) 30° and 60°

8) You are throwing a ball for the second time. If the ball leaves your hand with twice the velocity it had on your first throw, its horizontal range R (compared to your first serve) would be
a) 1.4 times as much. b) half as much. c) twice as much. d) four times as much

$(2v)^2 = 4v^2$ 4. $\frac{v^2 \sin\theta}{9.}$

Projectile Motion '24

9) When a football in a field goal attempt reaches its maximum height, how does its speed compare to its initial speed? a) It is zero. b) It is less than its initial speed. c) It is equal to its initial speed. d) It is greater than its initial speed.

10) (careful) A stone is thrown horizontally from the top of a tower at the same instant a ball is dropped vertically. Which object is traveling faster when it hits the level ground below?
a) It is impossible to tell from the information given. b) the stone c) the ball d) Neither, since both are traveling at the same speed.

11) A plane flying horizontally at a speed of 50.0 m/s and at an elevation of 160 m drops a package. Two seconds later it drops a second package. How far apart will the two packages land on the ground?

a) 100 m b) 162 m c) 177 m d) 283 m

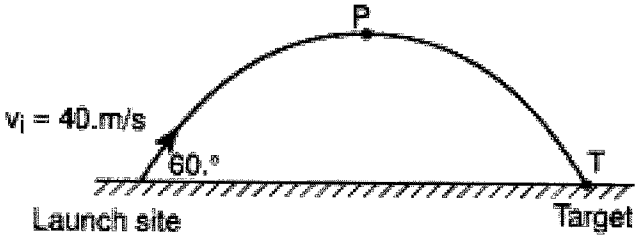
12) A pilot drops a bomb from a plane flying horizontally at a constant speed. Neglecting air resistance, when the bomb hits the ground the horizontal location of the plane will
a) be behind the bomb. b) be over the bomb. c) be in front of the bomb. d) depend on the speed of the plane when the bomb was released.

13) The acceleration of gravity on the Moon is only one-sixth of that on Earth. If you hit a baseball on the Moon with the same effort (and at the speed and angle) that you would on Earth, what would the new range be?
a) the same distance away. b) one-sixth as far. c) 6 times as far. d) 36 times as far.

14) A ball is dropped from a tower and falls for 2.5 s. How far did the ball fall?

15) An object is shot into the air at an angle of 30° and at a speed of 80 m/s. What is the vertical speed of the object?

16) An object is shot into the air at an angle of 30° and at a speed of 80 m/s. What is the horizontal speed of the object?



17) Fluffy came home in a really bad mood one day. To make things worse the kittens were noisy, they canceled his favorite show "Dancing with the Cats", and he was out of catnip. Out of rage he took his litter box and threw it at 40 m/s at a 60° angle (bad kitty). How much time was the litter box in the air?

$\frac{1}{2}(-9.8)(2.5)^2$

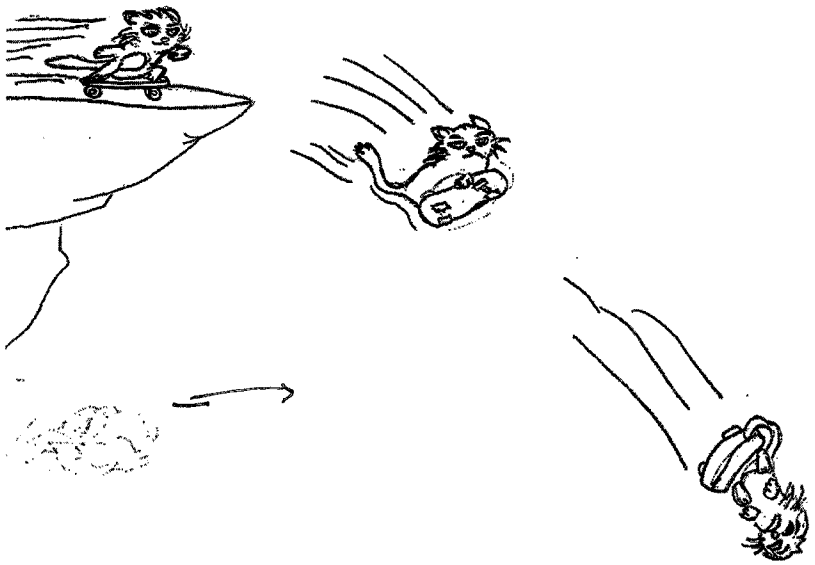
$\uparrow 40\sin 60$

1.07s

$V = u + at$

$0 = 40\sin 60 + (-9.8)$

Projectile Motion '24

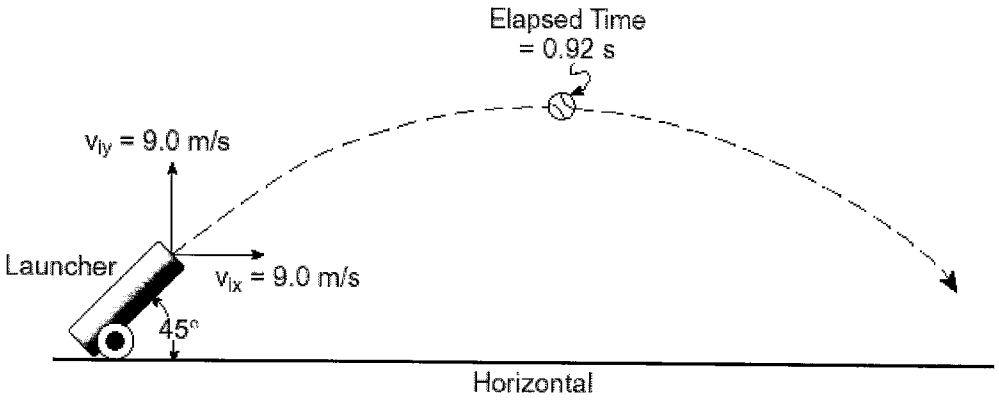


18) Fluffy in his bolder days was skateboarding and fell off a small ridge. His speed was an incredible 15 m/s in a horizontal direction (only). After three seconds of flight, how far is away Fluffy from base of the ridge? How far has Fluffy fallen?

$15^2 \sin($

$s = \frac{1}{2} \cdot (-9.8) \cdot 3^2$

A machine launches a tennis ball at an angle of 45° with the horizontal, as shown. The ball has an initial vertical velocity of 9.0 meters per second and an initial horizontal velocity of 9.0 meters per second. The ball reaches its maximum height 0.92 second after its launch. [Neglect air resistance and assume the ball lands at the same height above the ground from which it was launched.]



19) The actual speed of the tennis ball as it leaves the launcher is approximately
a) 4.5 m/s b) 8.3 m/s c) 13 m/s d) 18 m/s

20) The total horizontal distance traveled by the tennis ball during the entire time it is in the air is approximately
a) 23 m b) 17 m c) 8.3 m d) 4.1 m

R = _____

21) The speed at which the launcher fires the tennis balls is constant, but the angle between the launcher and the horizontal can be varied. As the angle decreases from 45° to 30°, the range of the tennis balls a) increases b) decreases
c) remains the same